PROCEEDINGS

OF THE

ROYAL SOCIETY OF EDINBURGH.

1833–4. No. 4.

January 20.

Sir THOMAS MAKDOUGAL BRISBANE, K. C. B.
President, in the Chair.

The following Donations were presented:—

Proceedings of the Royal Society, No. 13, and Statement of the Receipts and Payments of the Royal Society between Nov. 29. 1832 and Nov. 29. 1833.—*From the Society.*

Researches on Spherical Geometry, Polar Triangles, &c. By T. S. Davies, Esq.—*From the Author.*

Bulletin de la Société Géologique de France. Tome III. Feuilles, 17–24.—*From the Society.*

Memoirs of the Royal Astronomical Society. Vol. VI.—*From the Society.*

Astronomical Observations, made at the Royal Observatory at Greenwich in October, November, and December 1832, and January, February, and March 1833. By John Pond, Esq.—*From the Author.*

Observations of Nebulæ and Clusters of Stars, made at Slough with a twenty feet reflector, between the years 1825 and 1833. By Sir J. F. W. Herschel, K. H.—*From the Author.*

On the Absorption of Light by Coloured Media, viewed in connexion with the Undulatory Theory. By Sir J. F. W. Herschel, K. H.—*From the Author.*

Supplement to Dr Bradley's Miscellaneous Works, with an Account of Harriat's Astronomical Works. By Professor Regaud.—*From the Author.*

Mémoire sur le Choléra-Morbus compliqué d'une Epidémie de Fièvre Jaune, qui a regné simultanément à la Nouvelle-Orléans en 1832. Par M. Michel Halpheu, Docteur en Médecine. —*From the Author.*

Astronomische Nachrichten. Nos. 241 to 250.—*From Professor Schumacher.*

On the Influence of Colour and Heat on Odours. By James Stark, M. D.—*From the Author.*

Beiträge zur Petrefactenkunde. Von Hermann Von Mayer.—*From the Author.*

The following communication was read :—

On the Principle of Vital Attraction and Repulsion, with some applications to Physiology and Pathology. By Dr Alison.

The object of this paper was, to state and estimate the scientific value of a variety of facts, which have been recorded by various physiologists ; and many of which have been verified by personal observation, in proof of the proposition,—That the fluids of living bodies, or in immediate contact with them, are in many instances liable to movements,—dependent on the vitality of those bodies, but independent of any vital contractions of their solids,—and which can hardly be conceived to be effected otherwise than by certain *attractions* and *repulsions*, peculiar to the living state.

Five classes of observations, perfectly distinct from one another, were stated in proof of this general proposition.

I. The first are those made on the regular progressive movements of juices (made visible by whitish globules) in many kinds of vegetables, to which the name of *Rotation* has been given in the case of the cellular plants, such as the Chara and Caulinia, and that of *Cyclose* in the case of cellular plants with emitting juices, such as the different species of Ficus,—movements which go on nearly uniformly, under considerable variations of temperature, and of other external circumstances, while life continues ; and which are not only unattended with any visible contractions of the parietes of the cells or vessels containing the fluid, but are of such a nature, as no contractions of these parietes appear capable of producing, as appears particularly from the elaborate inquiries of Schultze, Amici, Nisbet, and Cassini. This conclusion is the more important, as it is probably applicable to nearly all the movements, peculiar to life, in the fluids of vegetables,

although the observations on which it rests can be satisfactorily made on those only which contain opaque globules.

II. The second set of facts are those connected with the *visible currents*, which take place in water, in contact with many living bodies; as ascertained, *first*, By the observations of Dutrochet and of Dr Grant on living sponges; *secondly*, By those of Dr Sharpey, M. Quillot, and M. Raspail, on many aquatic animals, chiefly mollusca and the larvæ of reptiles; and, *lastly*, By those of M. Raspail, and of many others, on certain animalcules, chiefly of the genus Vorticella. In all these instances, facts seem to be established, which are altogether inconsistent with the supposition of the movements depending merely on contractions or vibrations of any living solid textures.

III. The third class of facts adduced on this subject consists of those which show, that, in the fœtal state of animals, different parts are successively developed from the semi-fluid matter of the ovum; and the particles of that matter must therefore have been much and variously moved before the heart acts, or any contractile vessels have been formed; and farther, that the human ovum itself, during the time when it is surrounded on all sides by the shaggy chorion, must draw its nourishment from the semi-fluid matter contained in the uterus, through the filaments of the chorion, without the aid of any contracting vessels in these filaments. These points appear established by the observations of Prevost and Dumas, Breschet, Velpaeu, Raspail, and others.

IV. The author considers the existence of attractions and repulsions, peculiar to the living state, among certain of the particles of the blood of animals, to be established by due consideration of the following facts:

1. By the phenomena of the coagulation of healthy blood, and the utter absence of any contemporaneous mechanical or chemical change, adequate to explain the change of aggregation of the particles of the fibrin, on which that process depends.

2. By the great retardation of that process, when blood (although its circulation is arrested) is confined within a healthy living texture.

3. By the great acceleration of that process, when the living texture, in which blood is contained, is severely injured.

4. By the total suspension of that process, when death is produced by a sudden and violent cause, especially by a cause which at the same time destroys the power of contraction after death in muscular fibres.

5. By the different modifications of that process, which are observed in inflammation.

6. By the phenomena which are observed in those portions of blood, which are extravasated in inflamed parts.

In proof of these points, the author refers partly to personal observation, and partly to the works of Hunter, Hewson, Thackrah, Scudamore, Prater, Schræder van der Kolk, Velpeau, Gendrin, Royer-Collard, and Kaltenbrunner.

V. The last set of observations, adduced in support of the general principle, are those which, in reference to more complex questions in physiology, are the most important, viz. those which indicate that the blood circulating in the capillary vessels of living animals, and examined by the microscope, exhibit a variety of movements, and changes of movement, which no visible or conceivable vital contractions of the heart and arteries are adequate to explain.

Most of these facts, as to the capillary circulation, were accurately described, and the conclusion, which appears inevitable from them, as to the existence, in the living state, of a peculiar cause of movement inherent in the blood itself, or at least independent of any impulse from contracting solids, was stated and carefully limited by Haller. In regard to the rest, the author refers, not only to personal observations, but chiefly to the authority of Dollinger, Wedemeyer, and Kaltenbrunner in Germany, and of Quillot and Leuret in France.

The analogies which may be traced, between the principle which seems thus established, and other ascertained laws both of living beings and of inorganic matter; and the applications which may be made of it, to the explanation of the more complex phenomena of the living body in health and disease, were reserved for a future communication.

February 3.

Sir T. M. BRISBANE, President, in the Chair.

The following Donations were presented:—

1. Transactions of the Society of Arts, Manufactures, and Commerce, vol. XLIX.—*By the Society.*
2. Entomologia Edinensis, or a History and Description of the Insects found in the neighbourhood of Edinburgh. By James Wilson, Esq., and the Rev. James Duncan.—*From the Authors.*

The following communications were read:

1. Notice of some recent discoveries in Organic Chemistry. By William Gregory, M.D.

The author in this paper communicated to the Society an account of Creazote, a new organic principle lately discovered by M. Reichenbach, which possesses remarkable antiseptic properties, and is the source of the antiseptic power of wood-smoke, empyreumatic pyroligneous vinegar, and other empyreumatized substances; also of a very volatile fluid, lately put into his hands by Mr Enderby of London, which is obtained by the destructive distillation of caoutchouc, and possesses in a higher degree than any other menstruum the property of dissolving that substance; and lastly, of three new crystalline bodies which have lately been discovered by M. Robiquet, and other French chemists, in opium, and which are named Narceïne, Meconine, and Codeïne. Specimens of the several substances were exhibited.

The author stated, more particularly in regard to the last of these principles, that although in common with the two other newly discovered principles of opium, it constitutes an extremely small proportion of that drug, it may be obtained in a tolerably large quantity from the muriate of morphia of commerce, which appears to contain about a thirtieth of codeine.

From experiments made on various healthy individuals with codeine, obtained in this manner, he is led to infer, that in the doze of three, four, or five grains, it is distinctly stimulant in its action, and to suspect that it may be in part the cause of the disagreeable exciting effects produced by opium in some particular constitutions.

2. On the Structure, Position, and other particulars of a Fossil Tree found in Craigleith Quarry in the month of October last. By H. T. Maire Witham, Esq.

The author describes this fossil tree as lying at an angle of sixty degrees and a half, with its direction between S. E. by E. 10°, and N. W. by W. 10°. The strata in which it is imbedded dip at an angle of 20° towards the S. E. This tree differs from that which was found in the same quarry in 1830, in being much less flattened, indeed nearly cylindrical; and this difference appears to be accounted for by its almost vertical position, in consequence of which, the pressure of the surrounding medium would act in an equal degree all round the stem.

About fourteen feet of the stem have been exposed, and the thickest part measures three feet in diameter. The internal structure consists of uniformly elongated cellules, with medullary rays or plates, and the concentric circles, if any exist at all, are very indistinct. In the transverse section, the woody tissue presents the appearance of a regular radiating series of four-sided or subhexagonal cellules, with the usual medullary lines intervening. Two of the walls of the elongated cellules, those facing and parallel to the medullary plates, are regularly reticulated with two, three, or more series of contiguous subhexagonal areolæ.

The areolæ in both *Peuce* and *Pitus* are separated and roundish, whereas in the *Pinites* they are subhexagonal and continuous. This is the case with the fossil plant under consideration, which must therefore be referred to the last mentioned genus.

The constituents, according to an analysis by Dr Walker, are carbonate of lime 50.36, carbonate of iron 24.65, carbonate of magnesia 17.71, coal, silica, and a little water 6.15.

February 17.

JAMES RUSSELL, Esq. V. P., in the Chair.

The following Donations were presented :—

History of the Berwickshire Naturalist's Club, instituted September 1831.—*From the Club.*

Mémoires de la Société Géologique de France. Tome I. Part 1.—*From the Society.*

Mémoires de la Société de Physique et d'Histoire Naturelle de Génève. Tome II. Part 2. Tomes III. & IV.—*From the Society.*

Mémoires de l'Académie Royale des Sciences de l'Institut de France. Tome XII.—*From the Institute.*

The following Communications were read :—

1. Analysis of Coprolites from the Limestone of Burdie-House. By Arthur Connell, Esq.

These coprolites, as well as the limestone where they are found, contain a trace of animal matter, as ammonia is disengaged at a red heat.

Muriatic acid dissolves the greater part with slight effervescence. Ammonia throws down from the solution a copious gelatinous preci-

pitate of phosphate of lime ; and in the remaining fluid, oxalate o ammonia throws down oxalate of lime. The matter left undissolved by the muriatic acid is inflammable, leaving a small siliceous residue, and appears to be bituminous matter derived from the matrix. There is no magnesia, sulphur, nor fluorine.

The analysis of two coprolites, measuring from two inches to two inches and a half in length, and containing each a few fish scales, gave the following numerical results.

Phosphate of lime with a little oxide of iron.	85.08	83.31
Carbonate of lime, ...	10.78	15.11
Silica, ...	0.34	0.29
Bituminous matter, ...	3.95	1.47
	100.2	100.00

The proportion of phosphate of lime, appears thus to be pretty uniformly 5-6ths of the whole. The variation in the proportion of carbonate of lime may probably be influenced by the matrix, from which also the bituminous matter is derived. The limestone, when dissolved in muriatic acid, leaves a dark bituminous matter, in the proportion of 2.5 per cent.

2. Notice relative to the Polyzonal Lenses belonging to the Commissioners of the Northern Light-houses. By Alan Stevenson, Esq.

These lenses, which were exhibited to the Society by Mr Stevenson, are three in number. One, a plano-convex lens, two feet six inches square, was made by M. Soleil at Paris, under the superintendence of the late M. Fresnel. Another is a double-convex circular lens of flint-glass, three feet in diameter, which was constructed by the Messrs Gilbert of London, at the suggestion of Sir David Brewster. The third is a circular plano-convex lens. two feet six inches in diameter, cast in one piece as originally proposed by Buffon. This lens has been executed for the first time by the Messrs Cookson, plate-glass-makers, Newcastle.

The author, with the assistance of Mr John Adie jun., made a numerous set of observations, to determine the relative value of these lenses, and for this purpose ascertained, *first*, the mean focal distance of the central lens, and the several concentric rings of each, comparing the results with the focal distance of its aggregate surface; and

secondly, the mean diameter of the spectra produced in the focus, by the central lens and several zones separately, comparing this result also with the spectrum formed by the whole compound lens. The general results are as follows :—

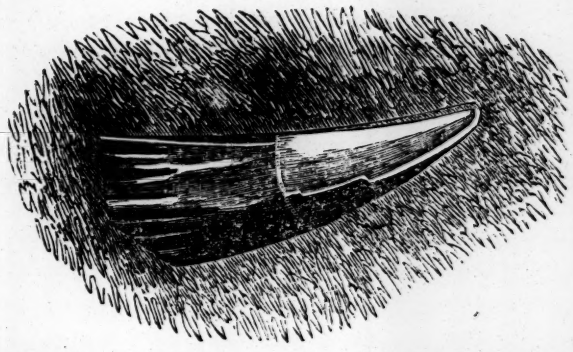
FRENCH.	Focal Dist. Feet.	In.	Diam. of Spec. In.
Mean for central lens and 5 rings severally, .	2	11.65	0.66
Aggregate surface of whole lens, . . .	3	0.25	0.70
Difference,	0	0.60	0.04
NEWCASTLE.			
Mean for central lens and 5 rings severally, .	2	11.97	0.57
Aggregate surface of whole lens, . . .	3	0.75	0.75
Difference,	0	0.78	0.18
LONDON.			
Mean for central lens and 4 rings severally, .	3	1.90	0.84
Aggregate surface of whole lens, . .	3	3.00	1.25
Difference,	0	1.10	0.41

The conclusion at which he arrives is, that the Newcastle lens is scarcely inferior to the lens made in Paris ; and that the Messrs Cookson are undoubtedly entitled to the merit of having successfully combated the difficulties which attend the making of polyzonal lenses in one piece,—difficulties previously considered insurmountable, but which they have overcome at the first attempt. The author expects that some of the particulars of the method by which they effected their purpose will be communicated to the British Association at their meeting at Edinburgh in September next.

3. Additional notice relative to the Freshwater Limestone in the vicinity of Edinburgh, belonging to the Carboniferous Group of Rocks. By Dr Hibbert.

In this paper, Dr Hibbert explained the progress which had been made, since he first pointed out the existence of plants as well as of fish and saurian animals, in the fresh-water limestone of Burdiehouse, towards a farther investigation of these animal remains.

The following is a representation of the first saurian relic discovered in the limestone of Burdiehouse by the author :—



The collection of specimens has been subsequently carried on by the Royal Society of Edinburgh, through their General Secretary Mr Robison.

The more important animal relics, which the limestone quarry has since yielded, are various kinds of fish, some of them referrible to the extinct race of the Palaeoniscus, large scales, evidently saurian, exhibiting a most brilliant lustre, and presenting in remarkable abundance what seem to be the epiphyses of vertebræ, numerous fragments of bones much broken, and teeth which, in their internal structure, give evidence of the dentition that is peculiar to animals more or less resembling the Crocodile, or Gavial.

a *b* *c*

The above figures represent the section of a tooth, obtained by Mr Robison, which had been accidentally broken in a longitudinal direction.

a shews the base of the tooth.

b is the reverse side of the same, in which a small internal cavity may be observed, indicative of a newer replacing tooth in an incipient state of growth.

c is the larger fragment of the tooth in which the newer tooth, of a conoid form, (protruded from its alveolus) is contained.

The cavities of the new tooth, and of the intermediate space of the old tooth, are at present filled with earthy substance.

The author then proceeded to point out other localities in which beds of fresh-water limestone crop out.

At East Calder, and to the south-west of Mid Calder, the limestone which is there quarried appears, like that of Burdiehouse, to have a fresh-water origin. Its strata have undergone great derangement, and dip in various directions. In one of the quarries of East

Calder, where a good section is exposed, the lowest rock is said to be sandstone, above which the following strata may be enumerated in an ascending order:—A yellowish coarse limestone, 16 feet thick;—limestone, 43 feet thick, in which vegetable remains are contained, such as are usually found in coal-fields, and, along with these, scales of Saurian reptiles;—nine feet of a very bituminous shale, part of which burns readily, mixed with ironstone;—shale (named Blaes) 16 feet;—and, at the top of the series, an alluvial covering of clay, sand, &c. in which large boulders occur.

Another site, where a fresh-water limestone crops out, is Kirkton, situated a mile or more east of Bathgate. Very interesting phenomena are here exhibited. The chemical action under which the deposit was elaborated, appears to have been so powerful as to have caused such miscellaneous earthy matters as are found to enter into the composition of an impure limestone, like that of Kirkton, to separate into laminæ, and to assume a sort of striped or ribboned disposition, resembling what the author has occasionally noticed in Auvergne, where tertiary strata have come into contact with volcanic rocks. The strata, for instance, of Kirkton quarry, are composed of distinct and alternating thin laminæ, some of them being of remarkable tenuity, variously consisting either of pure calcareous matter, of translucent silex, resembling common flint, or of a mixed argillaceous substance, approaching porcellanite in its character, or of ferruginous, or even of bituminous layers; and the surface of the two latter description of laminæ has often a sort of blistered appearance, as if from the effect of heat. Frequently also, in the purer limestone, a globularly concretional structure is observable. The whole of the strata of Kirkton quarry shew a kind of warping or curvature, which is to be traced no less in small detached specimens of the rock than in the contortions or wavings which are exhibited among the strata upon a large scale.*

All these appearances, in connexion with the remarkable circumstance, that greenish-coloured beds of trap-tuff of igneous origin, originally perhaps ejected in the form of a hot tufaceous mud, are interposed among the strata in divers places, one of which has acquired the thickness of nine feet, lead to the conclusion, that the calcareous beds of Kirkton in their elaboration were in immediate contiguity with some volcanic focus, and that in their original de-

* This limestone is extensively quarried for burning, and the Author has understood, that, although very impure, it possesses qualities which particularly recommend it to the use of the agriculturist. These are well deserving of further investigation.

velopment they must have exhibited the phenomena of hot springs charged with earthy matters, principally calcareous, such as are familiar to the geologist at the present day, in districts where the volcanic agency is still in activity.

From this fresh-water limestone the author collected several plants, viz. Ferns, &c. of the same kind as are usually found in the carboniferous group of rocks. No remains of fish, as far as he could learn, have yet been detected in the deposit, nor, considering the circumstances under which the limestone was formed, could they perhaps be reasonably expected; but he is inclined to suspect that relics of some amphibious animal allied to the tortoise have been occasionally discovered.

The upper strata of this deposit are either alternated with, or surmounted by, beds of argillaceous shale, mixed with seams of ironstone. The whole of the strata dip to the west or north by west, and are succeeded, as far as can be learned from the covered state of the ground, by alternating beds of sandstone and shale, which, at the distance of less than half a mile from Kirkton quarry, underlie thick limestone beds containing marine shells and corallines. Lastly, all the beds of this vicinity seem to have been surmounted by masses of feldspar rock, occasionally columnar.

The inference to be drawn from these observations, is, that the fresh-water deposit of Kirkton, like that of Burdiehouse, has an earlier date of origin than the marine limestone of the district, and that important geological changes, probably of a gradual nature, had contributed to depress the lacustrine deposits which had thus been formed, beneath the level of some subsequent invading ocean.

March 3.

SIR THOMAS MAKDOUGAL BRISBANE, K. C. B. President, in the Chair.

The following donations were presented:—

Letter to his Grace the Duke of Hamilton and Brandon, respecting the Parochial Registers of Scotland. By James Cleland, LL. D., &c.—*From the Author.*

Quarterly Journal of Agriculture; and the Prize Essays and Transactions of the Highland Society of Scotland. No. 24.—*From the Highland Society of Scotland.*

Print of the Statue of Sir Joseph Banks, Bart., G. C. B.—*From the Committee for conducting its execution.*

The following Communications were read:—

1. On a New Register Anemoscope. By Dr Traill.

The author's object was to obtain an instrument which might register the changes of the wind in the absence of the observer. For this purpose he connected a vane with a vertical axis, at the lower end of which the horizontal revolution was changed to a vertical revolution by bevelled wheels; and the axis of the vertical wheel carried an index and pencil; which described on a vertical dial of slate, or of polished porcelain, all the changes experienced by the vane above. In this manner, however, the instrument registered the changes occurring during only one revolution of the vane. In order to obtain the registration of a greater variety of changes,—when the wind has blown all round the compass more than once, the following addition was made. "Each bevelled wheel containing 42 teeth, a pinion of 21 leaves was fitted to the axis of the vertical wheel, which pinion plays in the teeth of a smaller wheel with 42 teeth also provided with a pinion of 21 leaves. This last moves a second small wheel of 42 teeth, which again turns round the axis of the primary vertical wheel. The last small wheel moves a second index which turns round the dial-plate once, while the vane and primary index make four complete revolutions. The second index carries a stud, which moves in either direction a pair of hands concentric with the indices, but not attached to their axis. This stud, then, will carry one of the hands through 90 degrees, while the vane has made one complete revolution; or the hands are capable of indicating four entire revolutions of the vane. The face of the instrument has three concentric graduations. The interior is the rhumbs of the mariner's compass; the second has the degrees of a circle; and the outer scale has four series of 360 degrees."

2. On the force of the Latin Prefix *ve* or *vae*. By the Rev. John Williams.

The author, after describing shortly the history of the philology of the Latin language, and alluding to the corruptions which were introduced into the science during the dark ages, proceeded to show that the prefix *ve* or *vae* must always be regarded either as an adjective signifying small, or an adverb having the force of the Latin *parum* or *minus*.

The term is to be found, in the opinion of the author, in most of the cognate languages of the great Caucasian branch of the human race, and still remains in Scotland under its Latin form *ve*, for the Latin V was undoubtedly pronounced like our W, [*ve, wee.*]

The words explained were the following. VE-CORS a small heart, in opposition to largeness of heart, synonymous with wisdom. VE-SANUS, not sound, *parum sanus*, insane. VE-DIUS, Pluto, the god of darkness, *parum dius*, not luminous. VE-JOVIS, the small jovis, *parum juvans*, not aiding. VE-PALLIDA, not pale, *parum pallida*, flushed. VESCUS and VESCULUS, having little to eat, *parum escæ*. Ve-SBIUS, the local and ancient name of Vesuvius, hardly extinct, *parum σβιστος*, a name given to it by the Greeks, on their first arrival on the Campanian coast, when Ischia, called by them Inarine, was the active scene of the volcano. VE-SICA, a small sack. VESPA, a small σφηξ, in opposition to the hornet. VE-SPERA, the period when objects become less distinct,—*parum spicere*,—in opposition to the morning-star, *lucifer*. VE-STIBULUM, a small standing-place between the street and the house-door,—*parum stabulum*. VE-STIGIUM a small impression, a small point, *vestigium temporis*, a point of time. VE-GRANDIS, not well grown, *parum grandis*.

3. Dr D. B. Reid exhibited some experiments on the heating power of the radiant caloric from the lime-ball light of Mr Drummond,—and illustrated, by means of the same light, the transparency of flame.

March 17.

JAMES RUSSELL, Esq. Vice-President in the Chair.

The following communications were read:—

1. Notice of Experiments on the Diminution of Intensity sustained by the Sun's rays in passing through the Atmosphere. By Professor Forbes.

This subject, though in itself deeply interesting, and leading to conclusions of much importance for elucidating many obscure questions connected with the constitution of the Universe, has hitherto received but little attention. *Bouguer* attempted to fix the actual amount of diminution approximatively, by comparing the moon's light with that of wax candles at different ascertained elevations; and in this way obtained data, from which he inferred, that about a fifth part of the entire rays of the sun is absorbed in traversing the atmosphere vertically. *Lambert* concluded, that the loss sustained is much greater. By observing at two altitudes of the sun, the difference of

temperature indicated by a thermometer in the shade and exposed to the sun's rays, and, determining by theory the proportion of air traversed at these altitudes, he inferred the loss at a vertical incidence to be $\frac{6}{10}$ths of the whole. On these slender foundations some philosophers have ventured to found most important conclusions on various subjects of transcendental speculation ;—such as the temperature of the sun's surface, and the temperature of planetary space.

Facts, however, of much greater value may be looked for, since the invention of Sir John Herschel's actinometer. Proceeding like Lambert on the principle, that the heating and illuminating powers of the sun's rays are proportional, this instrument measures the light by measuring the heat they produce. But, avoiding the great defect of Lambert's method, viz. the assumption, that the stationary condition of the thermometer is proportioned to the heating cause, a law which would only hold, if the cooling influence on the thermometer were invariable; Herschel proposes to ascertain, by an extremely delicate thermometer, *first*, the velocity of heating in the sun's rays, or the number of degrees passed through in a given short space of time, and then, *secondly*, the rate of cooling in the shade. The algebraic difference of these expresses the excess of one effect over the other. These data will obviously supply the means of measuring the true intensity of the sun's rays ; since the velocity of changing temperature is known by Newton's law to be the measure of the producing cause.

Having made these preliminary explanations, the author proceeded to observe, that, at the request of Sir John Herschel, he had made some observations with two instruments entrusted to him by that gentleman during his visit to the Continent in 1832. Twenty series of observations were made on six different days in Swizerland at various altitudes, the comparative observations being made by Professor Kamtz of Halle in the overland of Berne. The columns of air varied from 5000 to 7000 feet. On one day, observations were made every hour from sun-rise to sun-set. Every observation indicated increased radiation at the higher station, and the general diminution appeared to be not less than $\frac{1}{3}$th for the thickness just mentioned, which is a far greater proportion than was assigned even by Lambert.

The author found, by an extensive series of experiments made at the Observatory of Paris, that, in favourable circumstances, the numerical estimate of radiation by Herschel's instrument may be relied on to $\frac{1}{100}$th of its amount.

2. On the application of the Microscope to the examination of the minute phenomena of chemical action. By the Rev. Edward Craig. Communicated by Dr D. B. Reid.

Dr Reid read a notice by the Rev. Edward Craig, of some modes which he had adopted for examining by the microscope, the phenomena of chemical action, by means of which, the most minute changes of appearance attendant on the contact of the smallest visible quantities of substances may be observed. The method was described to be:

1. The laying two or more substances on two thin flat plates of glass, and bringing them in contact with each other; so that the whole matter is spread in one thin level between the two glasses; and the several processes of union, decomposition, and crystallization may be accurately watched in a field of view of $\frac{1}{3000}$th of an inch.

2. By using longer glasses which project beyond the port-object, and applying a small spirit-lamp underneath, the processes of boiling and evaporation may be observed.

3. By using only one glass-plate and a lens of smaller power, so that it may be raised above the vapours which would rise and condense upon it, the galvanic battery may be applied, and its effect on substances seen.

4. By laying a thin plate of tourmaline on the port-object, beneath the object to be examined, and a similar plate above the object-glass, crystals may be examined microscopically in polarized light.

These methods of observation seem to present facilities for the incipient processes of analysis, which may be a guide to subsequent experiments of a more measured kind.

3. On a Register Barometer for indicating Maxima and Minima. By Dr Traill.

The author gave an account of a new, easy, and economical method of ascertaining the maximum and minimum of the oscillations of the barometer during the absence of the observer. It consists of two tubes, the diagonal and rectangular barometer of the author, fixed in the same frame. A piece of thick iron wire is introduced into the upper part of the former, and a similar piece into the horizontal arm of the latter. These pieces of wire are pushed before the mercurial columns, and when the mercury recedes, they remain behind, like the index in Rutherford's thermometer. That in the diagonal barometer will give the maximum, the wire in the rectangular barometer will indicate the minimum. The portions of steel are to be replaced at the

extremities of the mercurial columns, for a fresh observation, by means of a magnet. The author has constructed an instrument on these principles, and found it to work well.

April 7.

SIR T. M. BRISBANE, President, in the Chair.

The following donations were presented :—

List of the Fellows of the Royal Society. Nov. 30. 1833.

Address delivered at the Anniversary Meeting of the Royal Society, on Saturday, Nov. 30. 1833, by His Royal Highness The Duke of Sussex, K. G., &c. &c. &c., the President.

Philosophical Transactions of the Royal Society of London, for the year 1833, part 2.

Proceedings of the Royal Society, 1832–33, No. 14.

Astronomical Observations made at the Royal Observatory at Greenwich, in April, May, June, July, August, and September 1833. By John Pond, Esq. Astronomer-Royal.

Supplements to the Greenwich Observations for the years 1830–32. By John Pond, Esq. Astronomer-Royal.

Catalogue of 1112 Stars, reduced from observations made at the Royal Observatory at Greenwich, from the years 1816 to 1833. —*From the Royal Society.*

Nouveaux Mémoires de l'Académie Royale de Bruxelles. Tomes 2, 3, 4, 5, and 7.

Mémoires de Prix de l'Académie Royale de Bruxelles. Tomes 2, 3, 5, 6, 7, 9.

Notices et Extraits des Manuscrits de la Bibliothêque dite de Bourgogne, rélatifs aux Pays-Bas; publiés par l'Académie Royale des Sciences et Belles-Lettres, pour faire suite a ses Mémoires. Par le Baron de Reiffenberg. Tome 1, part 1.

Rapport à Monsieur le Ministre de l'Intérieur sur les Travaux de l'Académie Royale des Sciences et Belles-Lettres de Bruxelles depuis le mois de Juillet 1830.

Bulletin de l'Académie Royale des Sciences et Belles-Lettres de Bruxelles, 1833–34. Nos. 15–19.—*From the Royal Academy of Brussels.*

Statistique des Tribunaux de la Belgique, pendant les années 1826–30. Par MM. A. Quetelet, Directeur de l'Observatoire

de Bruxelles, et Ed. Smits, Directeur du Bureau de Statistique. —*From the Authors.*

Recherches sur les Degrés successifs de Force Magnétique qu'une Aiguille d'Acier reçoit pendant les Frictions multiples qui servent à l'aimanter. Par M. Quetelet.—*From the Author.*

Astronomische Nachrichten. Nos. 251–257.—*From Professor Schumacher.*

Essai sur quelques Zodaiques apportés des Indes. Par M. de Paravey.

Etudes sur l'Archéologie. Par M. de Paravey.—*From the Author.*

Planum et Statuta Societatis Eruditæ Hungaricæ.

Annalium Societatis Eruditæ Hungaricæ volumen primum.—*From the Hungarian Literary Society.*

The Second Fasciculus of Anatomical Drawings, selected from the collection of Morbid Anatomy in the Army Medical Museum at Chatham.—*From Sir James Macgrigor, Bart.*

The following communications were read:—

1. Remarks on the Remains of an Oak dug from a Peat-moss near Lanfyne, Ayrshire. By Thomas Brown, Esq.

The oak described in this paper is believed by the author to have fallen into a small isolated lake, which had been subsequently filled up by the growth of aquatic plants, so as to form a peat-moss, in which the upper part of the tree has been completely preserved, with its bark entire. The tree had grown 500 feet above the level of the sea. The trunk was 48½ feet long, without any appearance of root. As it must therefore have been actually even longer, and the remains of other oaks were found near, it must have grown in a wood, probably forming a part of that division of the Caledonian forest, which, previous to the 14th century, covered Avondale and the upper part of Ayrshire. It must have contained 534 feet of measurable timber. The author conjectures, that the destruction of the forest commenced during the wars of the succession about the year 1300, and the contests between Edward I. and II. and Baliol and Bruce; for a number of silver pennies of the two Edwards had been found in the neighbourhood, but no coins of a later date. It is probable that these had been deposited by English soldiers soon before the battle of Bannockburn in 1314.

The author annexed some remarks on the remains of an undescribed Roman camp in the neighbourhood; and on a cairn of stones which

had formerly been heaped on the spot where the battle between Robert Bruce and Aymer de Valence was fought in 1307.

Some observations were also made on the small size and present neglected state of our oak-woods in Scotland, and on the idea that the oak is excellently suited to the moist climate of the west of Scotland.

2. Analysis of Levyine. By Arthur Connell, Esq.

A few years ago, this mineral was described as a new species by Sir David Brewster, on account of peculiar optical properties ascertained by himself, and its crystallographic characters, as determined by Mr Haidinger. Berzelius, however, inferred from the analysis of a specimen sent to him by Sir David Brewster, that it is merely a variety of chabazite, its chemical constitution appearing to be, Silica 48, Alumina 20, Lime 8.35, Magnesia 0.4, Potash 0.41, Soda 2.75, Water 19.30. But, from a subsequent explanation, it seemed probable that Berzelius had analyzed not the true levyine, but a mixture of this and chabazite, constituting the specimen which was sent. The author therefore considered it desirable to execute a new analysis of the mineral in question, which he has found to yield the following results :—

Silica, . . .	46.33
Alumina, . .	22.47
Lime, . . .	9.72
Soda, . . .	1.55
Potash, . . .	1.26
Oxide of Iron, .	0.77
Oxide of Manganese,	0.19
Water, . . .	19.51
	101.77

The specific gravity is 2.198, the fundamental crystalline form a rhomb 79° 29′, as stated by Mr Haidinger, while that of Chabazite is 94° 46′. Sir David Brewster found the crystals to possess one axis of double refraction, like other rhombohedral crystals, while the optical properties of chabazite are very anomalous. It is impossible, therefore, to consider the two minerals to be the same, without disregarding several marked differences.

April 21.

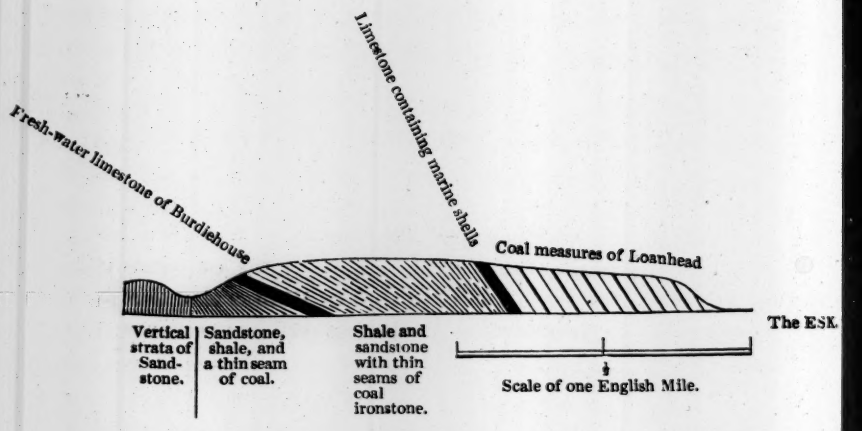
Sir THOMAS BRISBANE in the Chair.

The following Communications were read:—

1. Summary of the Discoveries hitherto made in the Ossiferous Beds of the Basins of the Forth and Clyde. By Dr Hibbert.

THE author gave a summary of the discoveries which had taken place during the course of the session relative to the ossiferous beds of the basins of the Forth and Clyde. The additional information contained in his paper comprised, in the first place, an account of the older class of strata upon which the carboniferous group of rocks (in which saurian remains had been found) were supposed, in an unconformable position, to rest. Some of these were referred to a system of beds, which geologists consider as of a newer transition class, intermediate to grauwacke schist and coal strata. Thus, it was found that a peculiar hard and gray sandstone, containing mica, and occasionally alternated with siliceous schist,—which in Shetland succeeds to clay-slate; which, near Loch Ness, succeeds to a transition granite; and, on the north of the Tay, to grauwacke schist,—was thrown up on the south of the Forth, near North Berwick, in the form of immense severed beds or fragments, shewing that this transition-rock (an important one in the series of Scottish strata) is to be regarded as in some places fundamental to the coal measures of the district. This older grey sandstone is also alternated, either with aluminous strata of the same general character, or with a hard sandstone of a reddish colour.

The carboniferous deposits inclosing saurian and other remains which rest in an unconformable position upon these strata, were formerly shewn to contain inferior beds of sandstone, shale, and freshwater limestone, together with very thin seams of coal and ironstone; and to be succeeded, first, by a limestone containing marine shells, encrinites, corallines, &c., and afterwards by extensive coal measures which formed the upper beds of the series. This is shewn in the following general section of the strata connected with the limestone of Burdiehouse.



In arguing from these appearances, the author considered that, at the commencement of the Carboniferous epoch, the coal beds of the Forth and Clyde did not, agreeably to received theories, indicate an Archipelago of islets, like those of the Pacific, little elevated above the level of the sea, but, on the contrary, an unbroken expanse, bounded on the north by the elevated ranges of the Grampians, and on the south by the high ridge of grauwacke schist which runs from St Abb's Head to the Mull of Galloway; and that while the higher lands might have encouraged the growth of coniferæ, the ferns, equiseta, and other monocotyledonous plants of our coal-fields, flourished amidst marshes, or on the borders of fresh-water lakes, tenanted by entomostraca, conchifera, and fish. and to which resorted various saurian animals. This land, as had been previously remarked, appears to have undergone a depression, probably of a gradual nature, by which it became liable to the inroads of the sea. Eventually, however, (as the extensive coal strata lying above the marine limestone sufficiently indicate), the land became once more elevated above the ocean, and again afforded a soil to the Flora of tropical climates.

The author next remarked, that he had found a fresh-water deposit, like that of Burdiehouse and Calder, to extend to Fifeshire, where it existed as a thinner bed; and that, in addition to the coprolites and fish discovered more than a year ago by Lord Greenock and Mr Trevelyan in the iron-stone nodules of Wardie, Mr Robison, General Secretary of the Royal Society, had procured saurian remains from the coal-field of Greenside near Glasgow, and had discovered

large coprolites in the shale which is associated with the sandstone of Craigleith quarry.*

Some remarks were made upon the remains of saurian animals, which had been more recently obtained for the Royal Society's Museum from the quarry of Burdiehouse, chiefly through the exertions of Mr Robison, and to which new acquisitions are daily adding. Among these, three distinct kinds seem to have been ascertained. The larger animal, the author thinks, rather approaches in character to the Steneosaurus of M. St Hilaire; but he suspects, at the same time, that such marks of difference exist, as must eventually authorize the assignment of the Edinburgh σαυρος to an entirely new genus. The other remains were supposed to resemble most those of the two kinds of Pterodactyli described by Cuvier. Bones also which appear to have belonged to a Trionyx have been discovered.

Lastly, the author adverted to prior notices of the actual discovery of saurian remains in the carboniferous group of rocks. Whitehurst, who wrote in the year 1778, and Pilkington, in his history of Derbyshire 1789, have each spoken of the remains of crocodiles and alligators which had been discovered in the limestone of Ashford in Derbyshire, from which locality the author has in his possession a specimen of freshwater limestone, like that of Burdiehouse, containing plants. Four years afterwards, namely, in the year 1793, saurian remains like those of Burdiehouse, found in a bed above a seam of coal, were actually figured by the Rev. Mr Ure in his History of Rutherglen near Glasgow, though he was not aware of their real character. And very lately the discovery of a saurian vertebra in the mountain-limestone of Northumberland, by the Rev. Charles Vernon Harcourt, has been recorded by Mr Lyell in his Principles of Geology.

The author, in concluding, expressed his reluctance to allude to other occasional notices which had been published, regarding the discovery of similar remains, on account of their having been mistaken for those of fish. But, if found necessary, he will complete the history.

2. Account of the Dissection of a Young Rorqual, or short Whalebone Whale, (the Balæna Rostrata of Fabricius); with a few Observations on the Anatomy of the Fœtal Mysticetus. By Dr Knox.

In February 1834, a young Whalebone Whale was taken near the

* Dr Fleming has, within these few days, found, at Clackmannan, an interesting relic, exhibiting large scales in a natural state of juxta-position (not imbricated), which will, of course, be described by himself.

Queensferry, in the Frith of Forth. After being exhibited for a short time by the proprietors, it was dissected by the author as carefully as time and circumstances would permit. The term Rorqual is employed throughout this memoir in the sense employed by M. Cuvier, as designating "Whalebone Whales, with longitudinal folds under the throat and chest." He thinks the present specimen quite distinct, specifically from the "Great Rorqual," (the Balæna boops, jubarte, musculus, &c.), and not as M. Cuvier seems to think it, a mere variety. Among other distinctions, the Great Rorqual has 13 dorsal, and 43 lumbar, sacral, and caudal vertebræ; while the individual now under consideration has only 11 of the former, and 36 of the latter. There are, therefore, at least two species of Rorquals inhabiting the North Seas, viz. the Great Rorqual, and the one now under consideration, a specimen of which was described by Fabricius (Balæna rostrata); another dissected by Hunter, and a third casually observed by James Watson, Esq., who sent a drawing of the same to Dr Traill, by whom it was communicated to Mr Scoresby.

The author had not leisure to examine the osteology with sufficient care; the following results have, in the mean time, been attained.

Internal and External Character.—Eight distinct bristles, arranged in perpendicular rows, were found in the extremity of the snout, in both jaws. The lower part of the mouth is a huge pouch, which, in the Great Rorqual, must at times contain a vast volume of water. The tongue was free towards the apex; and the inside of the mouth of a pale rose or vermilion colour.

The whalebone was about $2\frac{1}{2}$ inches in length, varied from a pale rose colour to a dull-white, and 614 large external plates were counted. No vestiges of teeth were found in either jaw; but it is not improbable that they exist in the fœtus of this species, as well as in that of the Mysticetus, in the lower jaw of which, lying imbedded below the gum, a series of teeth was discovered by M. Geoffroy St Hilaire several years ago; and in which the author of this paper has since observed them in the *upper jaw*.

Brain and Nervous System.—The cranium, besides containing the brain and its membranes, incloses a very large mass of a vascular substance, closely resembling an "erectile tissue." This forms an exception to the hitherto uniformly observed law of coincidence, at least in the Mammalia, between the configuration of the inner table of the skull and the contained brain. The erectile tissue filled a large proportion of the interior of the cranium, also three-fourths of the spinal canal, where it surrounded the spinal marrow and nerves; being in some places nearly two inches in thickness. The whole ce-

rebral mass, comprising two inches of the spinal chord, weighed 3½ pounds; while the cerebellum, pons, and two inches of the chord, weighed only three-fourths of a pound.

Respiratory Organs.—The mode of breathing, and the structure of the nostrils, was precisely as in the Great Rorqual. Two bolster-like substances filled the nostrils, which are withdrawn from them at the moment of breathing by muscles provided for that purpose. There are turbinated bones in the nose and olfactory nerves, as large at least as the human. The author thinks it impossible for water to be habitually spouted through the nostrils. The Whalebone Whales have complex nostrils, and smell and breathe precisely as the higher orders of the Mammalia.

The *Stomach,* composed of four compartments, contained no food. The middle tunic of the *ureter* was composed of distinct longitudinal muscular fasciculi.

The author then proceeded to consider, at some length, a question which has lately arisen relative to the structure and functions of the abdominal glands of the Cetaceæ, and which has been six or seven times before the French Institute in the course of the late and present session,—viz. Whether these glands are mammiferous? M. St Hilaire conceives that they are not mammæ, and do not secrete milk, but that they are probably similar to those of the *Ornithorynchus paradoxus,* which he thinks are sexual, specific, and odoriferous, but not mammiferous.

The author first observed, that the question ought, in strictness, to be limited to the Whalebone Whales among the Cetacea; because the great group of the *Delphinus* was proved to be mammiferous long ago by Mr Watson, an extract of whose observations is given in "Scoresby's Greenland." He next stated, that his own observations left, in his opinion, no doubt whatsoever, that the similarly situated glands in the *Balæna rostrata* are also true mammæ. An elaborate anatomical examination shewed that they resembled the lactiferous glands of other mammalia in their structure. A cursory examination of the fœtal *Mysticetus,* led to the same conclusion in regard to that genus; and the author was farther informed by a former pupil, Mr Auld, that in the young Mysticetus harpooned, he had seen a fluid of a cream colour and consistence, and oleaginous taste and smell, issue abundantly from the mouth; and, in the full-grown females, he had forced out several pounds of a similar fluid from the orifices of the glands by pressure of the foot on the abdomen.

The specimen of Balæna rostrata examined by the author was 9 feet 11 inches in length, 3 feet from snout to ear, and 4 feet 8 inches in girth at the termination of the plicæ and folds.